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Natural Hazards and Earth System Sciences
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Discussions

Interactive comment on "Analysis of instability conditions and failure mode of a special type of translational landslide using a long-period monitoring data: a case study of the Wobaoshi landslide (Bazhong city, China)" *by* Yimin Liu et al.

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Dear professor Darve:

We are very grateful to receive your referee comments (RC) again. As you said in short comments (AC), this manuscript needs to be modified and improved in two main aspects, the first is to build the geomechanical model with more comments about the limits of the equilibrium method in Section 3.1, on the other hand is to add more details about my FEM modeling in Section 3.2. After careful discussion by author and co-

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authors, we found that these comments are very important for improving the quality of this manuscript.

With your help and comments, especially FEM computations with Mohr Coulomb criterion and FEM computations with the second order work criterion, we realized that the geomechanical model of landslide is relatively simple, which is a purely static method, and it ignores the influence of strain history. Moreover, in the numerical simulation calculation, the boundary conditions are set relatively simple, and the working conditions considered are also less than the actual situation. And we want to use the DEM to establish the landslide model in next research, and discuss the influence of pore water pressure on the sliding body sliding and soil damage, and compare it with the existing model. These shortcomings in this manuscript will be improved in future research.

Please see the detailed revision, and we carefully proof-read the manuscript to minimize typographical, grammatical, and bibliographical errors, and the modified parts are marked in red in the revised manuscript in supplement online.

Thank you very much for your suggestion and consideration, and we look forward to get your constructive advice.

Best regards, Yimin Liu, Guiyun Gao and Chenghu Wang.

Detailed revision

1. To add in the paper some comments about the limits of the equilibrium method.

Modification:

With the help of references about limit equilibrium method and instabilities in geomaterials, we add the following supplement in Section 3.1.

According to characteristics of the Wobaoshi landslide in Section 1.2, when the geomechanical model is established, the cover layer is neglected, and the static geomechanical model of the plate-shaped rock sliding body is established based on the limit equilibrium method. The basic characteristic of the limit equilibrium method is that the Mohr-Coulomb failure criterion of the soil in static equilibrium conditions is considered, that is, the problem's solution is solved by analyzing the destruction of the soil's balance. And soli elastic-perfectly plastic model was chosen, which obey the Mohr-Coulomb failure criterion and associated flow rules (Darve et al., 2004; Labuz et al., 2015).

2. To give more details about your FEM modeling in the present state of your paper.

Modification:

This comment is very important for the paper, and the FEM modeling is lack of detailed description, we add the following supplement in Section 3.2.

The position of the right side of the landslide about 30m from the foot of the slope is selected as the right boundary of the model; the lower boundary is setted at the elevation of 0 m; the left boundary is located inside the mountain, about 30m away from the plate girder I. The element type adopts a plane strain quadrilateral-triangle mixing element, and the whole model is divided into 13775 elements and 14026 nodes. Here we constrain the vertical and horizontal displacement of its bottom boundary, and the left and right boundary conditions are set to constrain the horizontal displacement. The model uses steady-state seepage calculation, and the water levels at the left and right boundaries were set to 342 and 275 m, respectively. The typical pore-water-level data in the crack I and crack II presented in Table 3 were introduced into the finite element model, and were selected for a typical change period presented in Table 5.

3. The paper chose a so low friction angle of 11.2° for clay –what seems unrealistic.

Modification:

It is very interesting for the value of friction angle, and it seems too low and unrealistic, so we add the explanation and discussion in Section 4.2.

The internal friction angle, θ = 11.2°, is so low for clay, which seems unrealistic. However, the angle θ is obtained by triaxial compression tests of the core, which is taken from the sand-mudstone contact surface in sliding surface, and the internal friction angle θ = 11.2° (Chen et al., 2015). One of the reasons may be that the clay layer is severely weathered, so its internal friction angle is small. In general, the dilatancy effect obtained by the associated flow law is much larger than the actual observation, especially in the case of laternal infinite (Tschuchnigg et al., 2015a). However, for slope stability analysis, laternal infinite is not considered in most cases, and the dilatancy effect is not significant (Griffiths Lane, 1999). Therefore, it is reasonable to set the dilatancy angle to be equal to the internal friction angle.

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Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-133/nhess-2019-133-AC3-supplement.pdf

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Table 5 Loading steps of the water level in Crack I and II in FEM model

Loading Steps	Crack I	Crack II
0	314.50 m	311.00 m
1	316.00 m	313.00 m
2	317.50 m	315.00 m
3	316.00 m	313.00 m
4	314.50 m	311.00 m

Fig. 1. Table 5 Loading steps of the water level in Crack I and II in FEM model

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